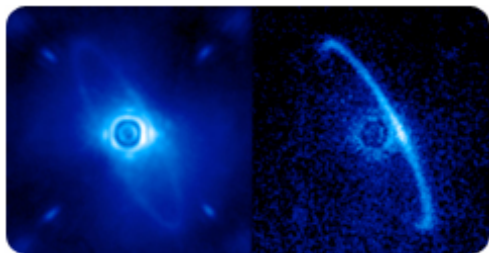


## LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Jan. 6-10, 2014.

### THE GLOBE AND MAIL AN EYE ON THE DISTANT SKY



**Gemini Planet Imager's first light image of the light scattered by a disk of dust orbiting the young star HR4796A.**

Though they spent a decade designing and building a camera for getting a snapshot of a distant world, Lawrence Livermore researchers still were surprised when they finally accomplished the feat.

LLNL's Bruce Macintosh and his colleagues witnessed just how well their new device -- called the Gemini Planet Imager (GPI) -- worked at picking out a planet orbiting more than 60 light-years from Earth. The result is a triumph for team members that marks a turning point in the effort to directly image solar systems beyond our own.

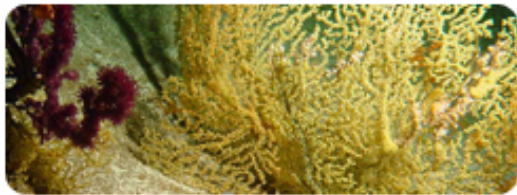
"Now we can start to get dozens of them," Macintosh said. "Hopefully, they'll just be falling off the telescope."

The doors on exoplanet observation have been blown wide open. Because it was specially designed for the task, GPI is the most efficient camera yet at locking onto a star and carefully subtracting away its light while allowing the light of an adjacent planet to pass through and form an image.

To read more, go to [The Globe and Mail](#).



**A LIVING TIME KEEPER**



**A Lawrence Livermore scientist and collaborators have studied coral to determine that a long-term shift in nitrogen content in the Pacific Ocean has occurred as a result of climate change. *Image courtesy of NOAA Hawaii Undersea Research Laboratory.***

Using deep sea corals gathered near the Hawaiian Islands, a Lawrence Livermore scientist, in collaboration with UC Santa Cruz colleagues, has determined that a long-term shift in nitrogen content in the Pacific Ocean has occurred as a result of climate change. The researchers looked to ancient corals as a timekeeper for the changes in ocean chemistry.

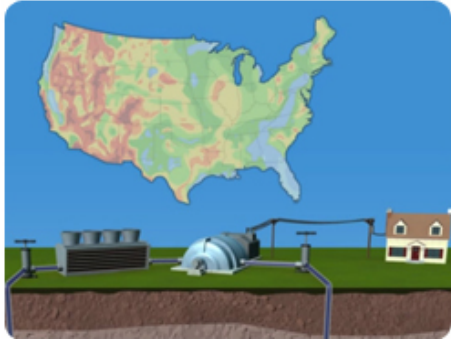
Overall nitrogen content in the North Pacific Ocean has increased by about 20 percent since the mid 1800s -- a shift similar to major paleoceanographic transitions in the sedimentary record -- and this long-term change appears to be continuing today.

Using chemical information locked in organic skeletal layers, the team used these ancient corals as detailed recorders of changes at the base of the open Pacific food web over the last 1,000 years. This represents the first detailed biogeochemical records for the planet's largest contiguous ecosystem.

To hear an interview with LLNL researcher Tom Guilderson, go to [Hawaiian Public Radio](#).



**ROCK AROUND THE CLOCK**



**Scientists illustrate their fresh approach to geothermal power. Credit: EnergyPathways.org**

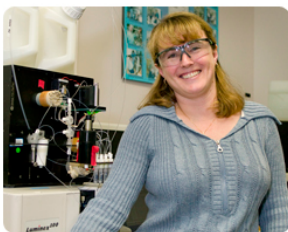
A team of scientists from Lawrence Livermore National Laboratory, the University of Minnesota and Ohio State University has developed a novel geothermal power plant design that leverages unwanted, captured carbon dioxide to boost both output and efficiency compared to conventional geothermal plants.

Geothermal power plants harness naturally occurring heat trapped between layers of rock below the earth's surface, which makes them capable of supplying clean, renewable electricity around the clock.

"There's an opportunity to deploy geothermal in many more places than possible with traditional plant designs," said Tom Buscheck, a geoscientist at LLNL. "We can harvest heat over much larger areas, in sedimentary formations with very permeable rock. I am hopeful. Geothermal really has been overlooked."

To read more, go to [Green Biz](#).

## **San Jose Mercury News ONE QUICK SOLUTION**



**LLNL chemical engineer Elizabeth Wheeler is working on a project to detect disease with a quicker and more efficient technology.**

You think you may have the flu, so you pay a visit to your doctor, and within minutes -- using a simple cheek swab placed in a tiny box -- he or she knows precisely which virus or bacteria is causing the symptoms and prescribes the right treatment.

It happens in a matter of minutes, rather than the hours or days it would take to get lab results. The technique may become a reality in health clinics worldwide within the decade, according to Lawrence Livermore Laboratory chemical engineer Elizabeth Wheeler.

Wheeler's team of engineers, biologists and chemists, headed by principal investigator Reginald Beer, is developing a method to recognize disease-causing pathogens quicker than ever before. The key: obtaining the bacteria or virus DNA and rapidly copying it so there's enough to identify what's causing your illness.

"It's basically like you're Xeroxing it," Wheeler said. "Once you've got enough of it, you can detect it."

To read more, go to the [San Jose Mercury News](#).



***These breathable membranes have pores made of a few nanometer-wide vertically aligned carbon nanotubes.***

In 2013, *PBS NewsHour* named some of the top science and technology gifts. Lawrence Livermore's carbon nanotube military apparel made the list.

The new fabric could save troops from a chemical attack by blocking chemical and biological agents.

Sarin, the chemical reportedly used in a poison gas attack that killed more than 1,400 people in Syria in August, is a highly toxic chemical; a drop the size of a pea is deadly. The attack shocked the global community and raised questions about how to protect the public from sarin gas.

Scientists have antidotes, but they must be applied in minutes. Now, Lawrence Livermore researchers are developing fabrics that are breathable, but protect against gas in case of an attack.

To read more, go to [PBS NewsHour](#).

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LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send [e-mail](#)